Regional Operational Plan CF.1J.2013.03

Operational Plan: McDonald Lake Sockeye Salmon Stock Identification, 2011–2014

by

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and

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August 2013

Alaska Department of Fish and Game **Divisions of Sport Fish and Commercial Fisheries**

Symbols and Abbreviations

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Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
nautical mile	nmi
ounce	oz
pound	lb
quart	qt
yard	yd

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s

Physics and chemistry

all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity (negative log of)	pH
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

General

Alaska Administrative Code	AAC
all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.
all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.
at	@
compass directions:	
east	E
north	N
south	S
west	W
copyright	©
corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
District of Columbia	D.C.
et alii (and others)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.
Federal Information Code	FIC
id est (that is)	i.e.
latitude or longitude	lat. or long.
monetary symbols (U.S.)	$, ¢
months (tables and figures): first three letters	Jan,...,Dec
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S.C.	United States Code
U.S. state	use two-letter abbreviations (e.g., AK, WA)

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	*e*
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	*E*
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	$\log_2$, etc.
minute (angular)	'
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

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OPERATIONAL PLAN: MCDONALD LAKE SOCKEYE SALMON STOCK IDENTIFICATION, 2011–2014

by

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SIGNATURE PAGE

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Approval

Title	Name	Signature	Date
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TABLE OF CONTENTS

Page

LIST OF TABLES ii
LIST OF FIGURES ii
LIST OF APPENDICES ii
PURPOSE 1
OBJECTIVES 1
BACKGROUND 1
STUDY SITE 3
METHODS 5
Purse Seine Sampling 6
District 106 and 108 Drift Gillnet Sampling 6
DATA ANALYSIS 7
SCHEDULE AND DELIVERABLES 8
RESPONSIBILITIES 9
REFERENCE CITED 10
APPENDICES 11

LIST OF TABLES

1. Number, size at release, and adult return years of otolith-marked sockeye salmon smolt released in McDonald Lake, 2009–2011. 3
2. Weekly sockeye salmon otolith sampling goals for the net fisheries in southern Southeast Alaska (Districts 101–108) in 2013. 7

LIST OF FIGURES

1. Estimated McDonald Lake sockeye salmon escapement, 1981–2012. Observed escapements were measured with weirs (1981, 1983, and 1984) and mark-recapture studies (2005, 2006, and 2007). Estimates for other years were based on expansion of peak foot survey counts. The bold black lines represent the current sustainable escapement goal range of 55,000–120,000 spawners. 3
2. Map of southern Southeast Alaska showing the location of McDonald Lake and the ADF&G commercial salmon regulatory districts and fishing areas affected by the McDonald Lake Sockeye Salmon Action Plan. 4

LIST OF APPENDICES

A. Distribution of coded wire tag recoveries of McDonald Lake sockeye salmon (expanded for fishery sample size) in the commercial fisheries of Southeast Alaska, 1985, and 1989–1991 12
B. Description of management actions from the McDonald Lake action plan. 13
C. ADF&G statistical week calendars, 2011–2014 14

PURPOSE

This multi-year project will provide current, area-specific migration and run timing information for stocked McDonald Lake fish to supplement recent genetic stock identification studies and help determine if fishery closures outlined in the McDonald Lake action plan (Bergmann et al. 2009) are effective at reducing harvest on this stock as intended.

Key words: drift gillnet, lake stocking, McDonald Lake, *Onchorynchus nerka*, otolith, otolith mark, purse seine, sockeye salmon.

OBJECTIVES

1. Estimate the weekly proportions of stocked McDonald Lake sockeye salmon in the commercial drift gillnet fisheries in subdistricts 106-30 and 106-41, and District 108.
2. Estimate the weekly proportions of stocked McDonald Lake sockeye salmon in the commercial purse seine fisheries in Districts 101, 102, and 107.

BACKGROUND

McDonald Lake has been considered the largest sockeye salmon-producing system in southern Southeast Alaska. Annual escapements averaged more than 90,000 fish in the 1980s and 1990s and this stock contributed substantially to several mixed-stock commercial fisheries (Johnson et al. 2005). McDonald Lake sockeye salmon are also harvested in a personal-use fishery in Yes Bay, near the mouth of Wolverine Creek (outlet stream to McDonald Lake). From 1985 to 2004, the annual personal-use harvest averaged 5,700 sockeye salmon, including a harvest of more than 10,000 fish in 1994 (Johnson et al. 2005). Because of its size, McDonald Lake is the only wild Alaska sockeye stock identified in the sockeye salmon run-reconstruction model currently used by the Northern Boundary Technical Committee of the Pacific Salmon Commission to allocate harvests of sockeye salmon in the boundary area (Gazey and English 2000, English et al. 2004).

Commercial harvest of McDonald Lake sockeye salmon occurs in distant, mixed-stock fisheries that do not target McDonald Lake fish, so comprehensive harvest information for this stock is limited (Johnson et al. 2005). Alaska Department of Fish and Game (ADF&G) coded-wire tagging studies showed that McDonald Lake sockeye salmon migrate around Prince of Wales Island through Sumner and Clarence straits to the north, and through Dixon Entrance to the south. They are harvested in all of the Alaska commercial net fisheries from Districts 101 through 107, as well as in British Columbia Areas 1 and 3 (Geiger et al. 2004, Hoffman et al. 1983 and 1984). Coded-wire tagged McDonald Lake sockeye salmon were recovered in southern Southeast Alaska commercial fisheries from early July through early September, primarily in the District 106 drift gillnet fishery, followed by purse seine fisheries in Districts 101, 102, and 104 (Johnson et al. 2005).

Due to a declining trend in escapement, low rearing fry estimates, and a series of escapements below the lower end of the sustainable escapement goal range (Figure 1), the Alaska Board of Fisheries classified McDonald Lake sockeye salmon as a stock of management concern in 2009 under the State of Alaska's *Policy for the Management of Sustainable Salmon Fisheries* (5 ACC 39.222). ADF&G developed an action plan to help rebuild the McDonald Lake sockeye salmon run back to levels that meet the current sustainable escapement goal range of 55,000–120,000

spawners. This plan contained management actions designed to reduce harvest on McDonald Lake sockeye stock (Appendix B), as well as projects to improve stock assessment at the lake and evaluate Southern Southeast Regional Aquaculture Association's (SSRAA) lake stocking project (Bergmann et al. 2009).

SSRAA conducted a lake stocking project to boost the spawning escapement and provide an opportunity to collect up-to-date information on the distribution and run timing of McDonald Lake sockeye salmon in the commercial fisheries. They collected eggs from 2007 to 2009 from the McDonald Lake sockeye salmon run and reared fish at their Burnett Inlet Hatchery. All fish were otolith-marked and returned to the lake as full-term smolt in the springs of 2009–2011 (Table 1). Smolt were held in net pens at the mouth of Hatchery Creek (the primary sockeye salmon spawning stream at McDonald Lake) for a day prior to release and were expected to immediately migrate to saltwater after imprinting on the spawning creek. These stocked otolith-marked fish will be tracked through the commercial fisheries when they return as adults from 2011 to 2014 after spending two to three winters at sea.

In addition to SSRAA's lake stocking project, ADF&G conducted a multi-year, genetic stock identification project to assess the distribution of McDonald Lake sockeye salmon in fisheries affected by the McDonald Lake action plan. From 2007 to 2010, tissue samples were collected weekly in the District 106 drift gillnet fishery and the District 101 purse seine fishery (along the Gravina Shore, subdistrict 101-29), and other purse seine fisheries in Districts 102, 104, 105, 106, and 107, when possible. Information from this project will be reported in 2013 (Sara Gilk, ADF&G Gene Conservation Laboratory, personal communication).

Commercial fishery closures designed to reduce exploitation of McDonald Lake sockeye salmon also reduce access to other healthy, more abundant stocks, as the migratory timing of McDonald Lake sockeye salmon broadly overlaps that of other sockeye, pink (*O. gorbuscha*) and chum salmon (*O. keta*) runs. McDonald Lake's stock of concern status was removed at the 2012 Board of Fisheries meeting as a result of recent increases in adult escapements and fall fry estimates. Although no longer required to implement the 2009 Action Plan fishery restrictions, managers may use them to conserve McDonald Lake stock during years of low sockeye salmon abundance.

From 2011 to 2014, we will collect samples from the weekly commercial drift gillnet and purse seine fisheries in southern Southeast Alaska to identify stocked, otolith-marked McDonald Lake sockeye salmon in the harvest. We will estimate the time and area distribution and proportion of stocked McDonald Lake sockeye salmon in weekly harvests through Bayesian hierarchical modeling (Geiger 1994, Gelman et al. 1995). Our intent is to relate information about stocked fish to the McDonald Lake sockeye salmon run as a whole since we assume that stocked fish will be representative of wild fish; i.e., stocked fish will be harvested in the same places, at the same time, and in the same relative abundance as wild fish. Data from this multi-year project will provide current, area-specific migration and run timing information for stocked McDonald Lake fish to supplement recent genetic stock identification studies and help determine if fishery closures outlined in the McDonald Lake action plan (Bergmann et al. 2009) are effective at reducing harvest on this stock as intended.

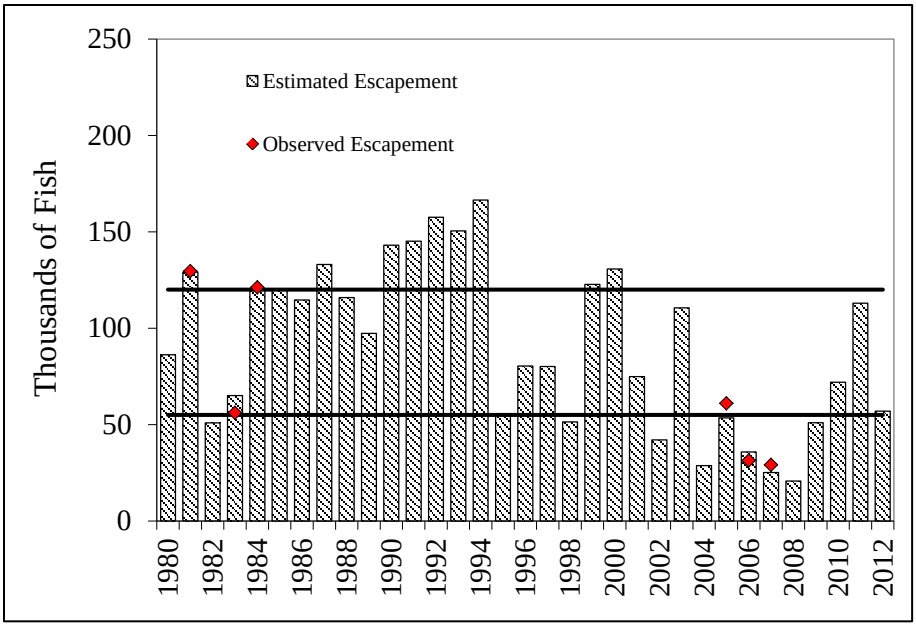

Figure 1.–Estimated McDonald Lake sockeye salmon escapement, 1981–2012. Observed escapements were measured with weirs (1981, 1983, and 1984) and mark-recapture studies (2005, 2006, and 2007). Estimates for other years were based on expansion of peak foot survey counts. The bold black lines represent the current sustainable escapement goal range of 55,000–120,000 spawners.

Table 1.–Number, size at release, and adult return years of otolith-marked sockeye salmon smolt released in McDonald Lake, 2009–2011.

Brood Year	Release Year	Release Date	Mean Weight (g)	Mean Length (mm)	Total Released	Ocean Age-2 and Age-3 Return Years
2007	2009	4-May-2009	6.8	86	276,000	2011–2012
2008	2010	26-Apr-2010	5.9	NA	175,000	2012–2013
2009	2011	6-May-2011	5.1	83	322,730	2013–2014

STUDY SITE

McDonald Lake is located on the northeast side of Cleveland Peninsula, 65 km north of Ketchikan, Southeast Alaska (55° 58’ N, 131° 50’ W; Orth 1967). Otolith samples will be collected in Ketchikan, Petersburg, and Wrangell from commercial net fisheries that take place throughout southern Southeast Alaska in Districts 101 through 108.

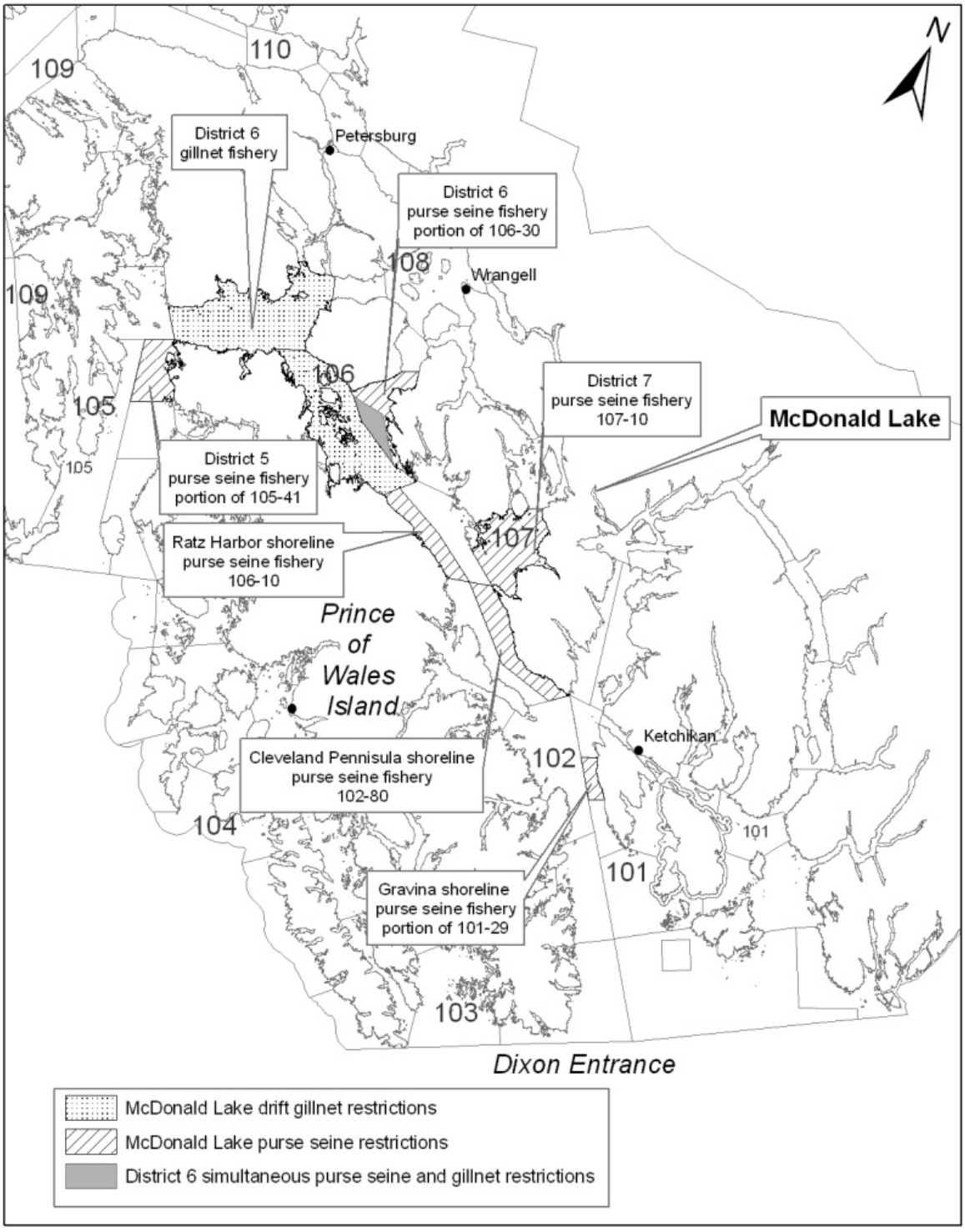

Figure 2.–Map of southern Southeast Alaska showing the location of McDonald Lake and the ADF&G commercial salmon regulatory districts and fishing areas affected by the McDonald Lake Sockeye Salmon Action Plan.

METHODS

Data collection and analysis will closely follow methods outlined for a similar project conducted in 2004–2007 to sample District 101 fishery catches for otolith-marked Hugh Smith Lake sockeye salmon (Heinl et al. 2007). Fishery harvests will be partitioned into weekly units, or *sampling domains*, based on ADF&G statistical weeks. ADF&G statistical weeks run from Sunday through Saturday and are numbered sequentially through the year (see Appendix C for 2011–2014 statistical weeks). The total harvest for each statistical week will be developed from the ADF&G fish ticket system, and we are calling the weekly harvest, "domains", to emphasize that the first estimates of interest are the weekly estimates of the proportion of otolith marks. The focus of our interest will be statistical weeks 25 to 35 (approximately mid-June to late-August).

Otoliths will be collected from both drift gillnet and purse seine harvests in such a way that the sample will approximate a random sample of all the fish in the district-wide harvest. Weekly otolith sampling goals will be matched as closely as possible to existing ADF&G Port Sampling objectives for collecting sockeye salmon tissue and scale samples. That is, most sockeye salmon otolith samples will be collected by ADF&G port samplers from the same fish that are sampled for tissues and scales in conjunction with sampling objectives for Northern Boundary fisheries. The only exception will be District 101 purse seine harvests, as District 101 will be split into two distinct areas (see below). In addition, we will incorporate results from ongoing sockeye salmon otolith sampling conducted in the District 106 and 108 drift gillnet fisheries in conjunction with management of transboundary Stikine River stocks (PSC 2005).

Sockeye salmon will be selected for sampling at processing facilities by ADF&G Port Samplers in Ketchikan, Petersburg, and Wrangell. Otoliths will be dissected from whole fish at processing facilities by making a dorsal-ventral cut through the rear of the fish's head, just forward of the body meat and the cartilage of the head and perpendicular to the axis of the fish's body. This cut will expose the brain cavity and sagittal wells that hold the otoliths without completely removing the head from the fish. If sampling at a processing facility that does not allow ADF&G personnel to cut heads, flagging will be attached to the lower jaw on the left side of the mouth while age, sex, and length data and tissue samples are collected. Flagged heads will be collected once the fish have been processed. The left and right sagittal otoliths will be removed from all sampled fish and placed into a single cell of a labeled, plastic, 96-cell tray. Otoliths will be cleaned later that day using a treatment described by Hagen et al. (1995): they will be soaked in a 0.5% chlorine solution for up to 8 minutes, followed by a rinse in dechlorinating solution (0.7% sodium thiosulfate), and a rinse in tap water. Otolith samples will be analyzed at the SSRAA Thermal Mark Laboratory.

Sampling goals for this project sum to a total sample of 6,500 otoliths to be collected in 2013 (not including samples from District 106 and 108 drift gillnet; Table 2). We assume we have resources to decode a total of 3,500 otoliths for the entire season. In practice, weekly sampling goals for some purse seine fisheries are not always met, either because the area was not open (e.g., District 107), effort or catches were too small to obtain sampling objectives, or because tender deliveries from some Districts are often mixed together (e.g., District 102). In the first two years of this project, 5,700 otoliths (2011) and 6,700 otoliths (2012) were collected in Ketchikan and Petersburg from sockeye salmon caught in the Districts 101, 102, 104, 105, and 107 drift gillnet and purse seine fisheries. Based on results from these two years, and to address funding concerns, we reduced the areas to be sampled in 2013. Areas where proportions of stocked

McDonald Lake sockeye salmon were extremely low (subdistrict 101-11 drift gillnet and District 104 purse seine) were eliminated to focus effort on areas where the majority of harvest occurs (Table 2).

PURSE SEINE SAMPLING

We must ensure that our sample very nearly approximates a random sample as we will be using a very small number of otoliths to make an inference about a very large number of fish. Otolith samples will be collected in such a way as to represent, as much as possible, all of the fish that were delivered by a boat or tender. We will collect up to 40 otoliths from an individual seine boat, and 80 otoliths from each tender sampled. If an individual seine boat delivers fewer than 40 total sockeye salmon we will collect otoliths from every sockeye salmon in the delivery. We will first estimate the number of sockeye salmon onboard the boat by dividing the total weight of sockeye salmon (in pounds of fish) by the industry average of six pounds for a sockeye salmon. The sampling rate will be determined by dividing the estimated number of sockeye salmon onboard by our sampling goal for the type of boat. Finally, we will sample every i^{th} fish, as determined from this calculation, as fish are unloaded from the tender, or from totes after the fish are unloaded. When it is not possible to collect fish for sampling following this method, fish may be collected in a manner that best approximates a representative yet random sample. Information recorded at the time of sampling will include the area fished, the date sampled, and the statistical week the fish were harvested.

District 101 purse seine harvests will be sampled at Ketchikan fish processing plants from statistical week 27 to 34 (approximately early July to late August). In order to obtain better information about the distribution of McDonald Lake sockeye salmon in the District 101 purse seine fishery, we will divide the district into two areas: what we will call the District 101 "inside" area (Revillagigedo Channel; subdistricts 101-23 and 41 combined) and the District 101 "outside" area (Clarence Strait; subdistricts 101-25 and 29 combined). The sockeye salmon harvest is typically much larger, and the stock composition more highly mixed, in the outside area in Clarence Strait compared to the inside area in Revillagigedo Channel. The sampling goal for the District 101 inside purse seine area will be 96 otoliths per week, and the sampling goal for the outside area will be 260 otoliths per week (Table 2). This is the only case in which the sampling objectives will be different for otoliths and scales/tissues (the scale/tissue sampling objective for District 101 is 260 per week from the entire district).

Sampling in other purse seine fisheries (Districts 102 and 107) will match Port Sampling objectives for scale/tissue sampling (Table 2). The weekly objective for Ketchikan is 260 otolith samples per week from District 2, and for Petersburg, the weekly objective for District 107 is 260 otolith samples per week. Weekly samples will be collected from statistical week 27 to 34 (approximately early-July to late-August).

DISTRICT 106 AND 108 DRIFT GILLNET SAMPLING

Otoliths will be collected from sockeye salmon in the District 106 and 108 drift gillnet fisheries through an ongoing sampling program to support management of transboundary Stikine River stocks (PSC 2005), and results will be incorporated into this study. Otolith samples will be collected from statistical week 25 to 35 (approximately mid-June to late August). Sampling goals include 300 otoliths per week each in subdistrict 106-30 and subdistrict 106-41, and 260 per week each in subdistricts 108-30/40 and subdistricts 108-50/60 (Table 2). Sampling the

subdistrict 106-30 drift gillnet fishery will be conducted primarily on the fishing grounds by an observer onboard a fish buying tender. Matched scale and tissue samples will be collected from a maximum of 40 sockeye salmon from individual boat deliveries to the tender, and the heads of each sampled fish will be marked with a numbered otolith coordination tag. The heads of tagged fish will be recovered after delivery to processors in Ketchikan, Petersburg, and Wrangell.

Table 2.–Weekly sockeye salmon otolith sampling goals for the net fisheries in southern Southeast Alaska (Districts 101–108) in 2013.

Fishery (Subdistricts)	Port			Weekly Sample	Statistical Weeks	Number of Weeks	Number of Samples
	Ketchikan	Petersburg	Wrangell				
101 Seine (23, 41) [a]	96	0	0	96	27–34	8	768
101 Seine (29, 25) [a]	260	0	0	260	29–34	6	1,560
102 Seine	260	0	0	260	27–34	8	2,080
107 Seine	0	260	0	260	27–34	8	2,080
Sub Total	616	260	0	876			6,488
106-30 Gillnet[b]	300	0	0	300	25–35	11	3,300
106-41 Gillnet[b]	0	300	0	300	25–35	11	3,300
108 Gillnet (30, 40) [b]	0	0	260	260	25–34	10	2,600
108 Gillnet (50, 60) [b]	0	260	0	260	25–34	10	2,600
Grand Total	916	820	260	1,996			18,288

[a] Otolith sampling objectives for District 101 purse seine are slightly different than for scale and tissue sampling—scale and tissue sampling objectives are for a total of 260 samples per week from the entire district.

[b] Samples from drift gillnet fisheries in Districts 106 and 108 will be collected and analyzed through PSC management projects.

DATA ANALYSIS

Data analysis will be very similar to that outlined in Heinl et al. (2007). Let π_i denote the proportion of otolith marks in one of the sampling domains (i.e., statistical weeks), and suppose there are D total domains (i = 1,2,3, ... D). Let n_i denote the number of sampled otoliths decoded in statistical week i, and let x_i denote the number of otolith marks observed from statistical week i. We assume independent binomial models for the number of otolith marks, x_i:

$$x_i \sim \text{Bin}(n_i, \pi_i),\ i = 1, \ldots D,$$

with the number of sampled otoliths decoded, n_i , known. The parameters π_i are assumed to be independent samples from a beta distribution:

$$\pi_i \sim \text{Beta}(\alpha, \beta),\ i = 1, \ldots D.$$

The beta distribution is a prior distribution for π_i.

To estimate the prior parameters, α and β, we will use all the data, $\{\pi_i\} = \{x_i / n_i\}$, from total domains ($i$ = 1 ... D). Since $\pi_i \sim$ Beta (α, β), we have:

$$E(\pi_i) = \frac{\alpha}{\alpha+\beta}, \text{var}(\pi_i) = \frac{\alpha\beta}{(\alpha+\beta)^2(\alpha+\beta+1)};$$

Then we have:

$$\alpha + \beta = \frac{E(\pi_i)(1 - E(\pi_i))}{\text{var}(\pi_i)} - 1,$$

$$\alpha = (\alpha + \beta)E(\pi_i), \text{ and}$$

$$\beta = (\alpha + \beta)(1 - E(\pi_i)).$$

$E(\pi_i)$ and $var(\pi_i)$ will be estimated as the sample mean, $\bar{\pi} = \frac{1}{D}\sum_{i=1}^{D}\pi_i$, and sample variance, $s^2 = \frac{1}{D-1}\sum_{i=1}^{D}(\pi_i - \bar{\pi})^2$, respectively. The analysis using the data to estimate the prior parameters is called empirical Bayes (Gelman 2004).

The beta distribution is a conjugate prior for binomial likelihood; that is, the posterior distributions are also beta distributions with new parameters, $(\alpha + x_i)$ and $(\beta + n_i - x_i)$:

$$\pi_i|(x_i \text{ and } n_i) \sim \text{Beta}(\alpha + x_i, \beta + n_i - x_i), i = 1,2,3, \ldots D.$$

The posterior mean of π_i, given x_i and n_i, which can be interpreted as the proportion of otolith marks from the population in statistical week *i*, is now

$$E(\pi_i) = \frac{\alpha + x_i}{\alpha + \beta + n_i}, \quad (1)$$

which always lies between the sample proportion, x_i / n_i, and the prior mean, $\alpha /(\alpha+\beta)$. The posterior variance is

$$\text{var}(\pi_i) = \frac{(\alpha + x_i)(\beta + n_i - x_i)}{(\alpha + \beta + n_i)^2(\alpha + \beta + n_i + 1)}. \quad (2)$$

Inference about the proportions of otolith-marked sockeye salmon in each domain will be calculated through this posterior distribution. We will then report the posterior mean and a measure of precision (credible interval) for each sampling domain.

SCHEDULE AND DELIVERABLES

Otolith samples will be collected from mid-June through late August 2013 and 2014; the drift gillnet fishery will be sampled from mid-June to late August, and the purse seine fishery will be sampled from early July to late August. Otolith samples will be analyzed at the SSRAA Thermal Mark Laboratory (Ketchikan, AK) September 2013 to March 2015. Data analysis and report writing will be conducted from November 2013 through June 2015. Results will be presented to the public at annual meetings of the Gillnet and Purse Seine Task Forces and will be incorporated into other ongoing studies of McDonald Lake sockeye salmon. A final report in the form of an ADF&G Fishery Manuscript covering all years of the study (2011–2014) will be completed by the project leader.

RESPONSIBILITIES

Malika T. Brunette, Fishery Biologist II, Project Leader. Oversight of all aspects of project, including planning, budgeting, coordinating with ADF&G and SSRAA personnel, and training. Collects and analyzes data and reports project results.

Andrew W. Piston, Fishery Biologist III, Project Leader. Assists with all aspects of the project, including operational planning, field work, data analysis, and technical report writing.

Steven C. Heinl, Regional Research Biologist IV. Assists with project operational planning and review of project report.

Anne Reynolds (Regional Port Sampling Supervisor), Anna Buettner (Ketchikan Port Sampling Supervisor), and Jeff Rice (Petersburg Port Sampling Supervisor) will facilitate collection of commercial fisheries samples.

Haixue Shen, Biometrician II, will assist with and conduct statistical analyses of fisheries samples.

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APPENDICES

Appendix A.–Distribution of coded wire tag recoveries of McDonald Lake sockeye salmon (expanded for fishery sample size) in the commercial fisheries of Southeast Alaska, 1985, and 1989–1991.

	Proportion of Total McDonald Harvest				
Area and Gear	**1985**	**1989**	**1990**	**1991[1]**	**Average**
District 101-11 Gillnet	7%	2%	2%	26%	9%
District 101 Annette Island Gillnet	4%	2%	7%	0%	3%
District 101 Seine	40%	8%	9%	15%	18%
District 101 Annette Island Seine	3%	0%	0%	5%	2%
District 101 Annette Island Trap	1%	0%	0%	0%	<1%
District 102 Seine	9%	17%	9%	16%	13%
District 103 Seine	0%	0%	<1%	0%	<1%
District 104 Seine	10%	13%	17%	32%	18%
District 106 Gillnet	28%	57%	56%	6%	37%
District 107 Seine	0%	0%	0%	0%	<1%
District 102 Troll	0%	0%	<1%	0%	<1%
Total Tags Recovered	47	90	190	32	90
Total Expanded Tags	203	370	670	112	339

[1] Tag recovery information for 1991 is included here for completeness; however, we point out that the information may be biased and not representative of untagged fish. Coded-wire tag returns in 1991 were compromised by a very low rate of tagging in 1988, and tags were not applied throughout the entire smolt outmigration period: fewer than 6,000 smolts were tagged (compared to 22,000 in 1986, and 38,000 in 1987), 51% of which were tagged during the last three days of the six-week tagging period (Johnson et al. 2005).

Conservation measures in the McDonald Lake action plan were in the form of reduced openings in Districts 101, 102, 105, 106, and 107 (Figure 1). Reduced openings were enacted during a four-week time span (statistical weeks 29–32) to allow more McDonald Lake sockeye salmon to pass through these fisheries when they were thought to be present in the largest numbers based on coded-wire tag data (Bergmann et al. 2009).

- **District 101 purse seine**: From statistical weeks 29 through 31, the purse seine fishery on the western shore of Gravina Island (subdistrict 101-29) will be closed north of the latitude of Cone Point (equates to a 50% reduction in the area open to fishing).
- **District 102 purse seine**: From statistical weeks 29 through 32, the purse seine fishery on the western shore of the Cleveland Peninsula (within three nautical miles of the shoreline; subdistrict 102-80) will be closed.
- **District 105 purse seine**: From statistical weeks 29 through 31, the District 105 purse seine fishery along the northwest corner of Prince of Wales Island between Point Baker and the Barrier Islands (part of subdistrict 105-41) will remain closed.
- **District 106 purse seine**: From statistical weeks 29 through 31, the District 106 purse seine fishery along the west side of Etolin Island between Point Stanhope and the latitude of Round Point (part of subdistrict 106-30) will remain closed. From statistical weeks 29–31, the District 106 purse seine fishery along the east side of Prince of Wales Island between Luck Point and Narrow Point (subdistrict 106-10) will remain closed.
- **District 107 purse seine**: From statistical weeks 29 through 31, the District 107 purse seine fishery in Section 7-B will remain closed (subdistrict 107-10). If pink salmon runs are extremely strong, the northern portion of section 7-B, north of Union Point may be open during statistical week 31. If this occurs, restrictions may occur in that area south of Union Point into statistical week 32 to reduce the overall interception of sockeye salmon.
- **District 106 drift gillnet**: From statistical weeks 29 through 31, the District 106 drift gillnet fishery will open for a maximum of two days.

Appendix C.–ADF&G statistical week calendars, 2011–2014.

	2011		2012		2013		2014	
Week	**Start**	**End**	**Start**	**End**	**Start**	**End**	**Start**	**End**
1	1-Jan	1-Jan	1-Jan	7-Jan	1-Jan	5-Jan	1-Jan	4-Jan
2	2-Jan	8-Jan	8-Jan	14-Jan	6-Jan	12-Jan	5-Jan	11-Jan
3	9-Jan	15-Jan	15-Jan	21-Jan	13-Jan	19-Jan	12-Jan	18-Jan
4	16-Jan	22-Jan	22-Jan	28-Jan	20-Jan	26-Jan	19-Jan	25-Jan
5	23-Jan	29-Jan	29-Jan	4-Feb	27-Jan	2-Feb	26-Jan	1-Feb
6	30-Jan	5-Feb	5-Feb	11-Feb	3-Feb	9-Feb	2-Feb	8-Feb
7	6-Feb	12-Feb	12-Feb	18-Feb	10-Feb	16-Feb	9-Feb	15-Feb
8	13-Feb	19-Feb	19-Feb	25-Feb	17-Feb	23-Feb	16-Feb	22-Feb
9	20-Feb	26-Feb	26-Feb	3-Mar	24-Feb	2-Mar	23-Feb	1-Mar
10	27-Feb	5-Mar	4-Mar	10-Mar	3-Mar	9-Mar	2-Mar	8-Mar
11	6-Mar	12-Mar	11-Mar	17-Mar	10-Mar	16-Mar	9-Mar	15-Mar
12	13-Mar	19-Mar	18-Mar	24-Mar	17-Mar	23-Mar	16-Mar	22-Mar
13	20-Mar	26-Mar	25-Mar	31-Mar	24-Mar	30-Mar	23-Mar	29-Mar
14	27-Mar	2-Apr	1-Apr	7-Apr	31-Mar	6-Apr	30-Mar	5-Apr
15	3-Apr	9-Apr	8-Apr	14-Apr	7-Apr	13-Apr	6-Apr	12-Apr
16	10-Apr	16-Apr	15-Apr	21-Apr	14-Apr	20-Apr	13-Apr	19-Apr
17	17-Apr	23-Apr	22-Apr	28-Apr	21-Apr	27-Apr	20-Apr	26-Apr
18	24-Apr	30-Apr	29-Apr	5-May	28-Apr	4-May	27-Apr	3-May
19	1-May	7-May	6-May	12-May	5-May	11-May	4-May	10-May
20	8-May	14-May	13-May	19-May	12-May	18-May	11-May	17-May
21	15-May	21-May	20-May	26-May	19-May	25-May	18-May	24-May
22	22-May	28-May	27-May	2-Jun	26-May	1-Jun	25-May	31-May
23	29-May	4-Jun	3-Jun	9-Jun	2-Jun	8-Jun	1-Jun	7-Jun
24	5-Jun	11-Jun	10-Jun	16-Jun	9-Jun	15-Jun	8-Jun	14-Jun
25	12-Jun	18-Jun	17-Jun	23-Jun	16-Jun	22-Jun	15-Jun	21-Jun
26	19-Jun	25-Jun	24-Jun	30-Jun	23-Jun	29-Jun	22-Jun	28-Jun
27	26-Jun	2-Jul	1-Jul	7-Jul	30-Jun	6-Jul	29-Jun	5-Jul
28	3-Jul	9-Jul	8-Jul	14-Jul	7-Jul	13-Jul	6-Jul	12-Jul
29	10-Jul	16-Jul	15-Jul	21-Jul	14-Jul	20-Jul	13-Jul	19-Jul
30	17-Jul	23-Jul	22-Jul	28-Jul	21-Jul	27-Jul	20-Jul	26-Jul
31	24-Jul	30-Jul	29-Jul	4-Aug	28-Jul	3-Aug	27-Jul	2-Aug
32	31-Jul	6-Aug	5-Aug	11-Aug	4-Aug	10-Aug	3-Aug	9-Aug
33	7-Aug	13-Aug	12-Aug	18-Aug	11-Aug	17-Aug	10-Aug	16-Aug
34	14-Aug	20-Aug	19-Aug	25-Aug	18-Aug	24-Aug	17-Aug	23-Aug
35	21-Aug	27-Aug	26-Aug	1-Sep	25-Aug	31-Aug	24-Aug	30-Aug
36	28-Aug	3-Sep	2-Sep	8-Sep	1-Sep	7-Sep	31-Aug	6-Sep
37	4-Sep	10-Sep	9-Sep	15-Sep	8-Sep	14-Sep	7-Sep	13-Sep
38	11-Sep	17-Sep	16-Sep	22-Sep	15-Sep	21-Sep	14-Sep	20-Sep
39	18-Sep	24-Sep	23-Sep	29-Sep	22-Sep	28-Sep	21-Sep	27-Sep
40	25-Sep	1-Oct	30-Sep	6-Oct	29-Sep	5-Oct	28-Sep	4-Oct
41	2-Oct	8-Oct	7-Oct	13-Oct	6-Oct	12-Oct	5-Oct	11-Oct
42	9-Oct	15-Oct	14-Oct	20-Oct	13-Oct	19-Oct	12-Oct	18-Oct
43	16-Oct	22-Oct	21-Oct	27-Oct	20-Oct	26-Oct	19-Oct	25-Oct
44	23-Oct	29-Oct	28-Oct	3-Nov	27-Oct	2-Nov	26-Oct	1-Nov
45	30-Oct	5-Nov	4-Nov	10-Nov	3-Nov	9-Nov	2-Nov	8-Nov
46	6-Nov	12-Nov	11-Nov	17-Nov	10-Nov	16-Nov	9-Nov	15-Nov
47	13-Nov	19-Nov	18-Nov	24-Nov	17-Nov	23-Nov	16-Nov	22-Nov
48	20-Nov	26-Nov	25-Nov	1-Dec	24-Nov	30-Nov	23-Nov	29-Nov
49	27-Nov	3-Dec	2-Dec	8-Dec	1-Dec	7-Dec	30-Nov	6-Dec
50	4-Dec	10-Dec	9-Dec	15-Dec	8-Dec	14-Dec	7-Dec	13-Dec
51	11-Dec	17-Dec	16-Dec	22-Dec	15-Dec	21-Dec	14-Dec	20-Dec
52	18-Dec	24-Dec	23-Dec	29-Dec	22-Dec	28-Dec	21-Dec	27-Dec
53	25-Dec	31-Dec	30-Dec	31-Dec	29-Dec	31-Dec	28-Dec	31-Dec